METHOD AND APPARATUS FOR SCENE SEGMENTATION FROM FOCAL STACK IMAGES

TECHNOLOGICAL FILED

[0001] An example embodiment of the present invention relates generally to image manipulation and segmentation and, more particularly, to scene segmentation from focal stack images.

BACKGROUND

[0002] Modern digital cameras may provide the capability of capturing multiple focal stack images. Each of the focal stack images may focus on a different focus plane. The focus information allows segmentation of the foreground and background of the focal stack images.

[0003] Conventionally, a focus measure is calculated for each pixel, classifying each sharp pixel as foreground and each blurry pixel as background. However the per pixel focus measurement is not always reliable, especially in areas with depth discontinuity and texture weak areas. Further, the segmentation calculations are inefficient when using sophisticated segmentation techniques. For example, if graph-cut algorithm is used, each pixel will form a node on the graph, making the graph extremely large resulting in long computation time.

[0004] There is a lack of balance between incorporating user input into the segmentation calculations and minimizing user burden. User input is either not used in the calculations, or the user input requires significant detail and is burdensome to the user.

BRIEF SUMMARY

[0005] A method, apparatus and computer program product are provided in accordance with an example embodiment in order to facilitate the scene segmentation from focal stack images. As such, a set of focal stack images may have its associated pixels grouped into super pixels. A focal measurement and color probability may be calculated for each super pixel. The super pixels may be segmented based on the focal measurement and for the color probability.

[0006] In an example embodiment, a method is provided that includes receiving a set of focal stack images; calculating a focal measure for each of a plurality of pixels of the set of focal stack images; grouping each of a plurality of pixels for which the focal measure was calculated into a plurality of super pixels; calculating a focal measure for each of a plurality of the super pixels; segmenting a respective focal stack image based on the focal measures of the plurality of super pixels; calculating a color probability for respective super pixels; and segmenting the respective focal stack image based on the color probability of respective super pixels.

[0007] The method of an example embodiment may also include selecting a representative plurality of focal images from the set of focal stack images. The method of an example embodiment may also include aligning the set of focal stack images. In another example embodiment the method may also include receiving a selection of a focus frame; wherein the segmenting the respective focal stack image based on focal measure is further based on the selected focus frame; and wherein the segmenting the respective focal stack image based on color probability is further based on the selected focus frame.

[0008] The method of an example embodiment may also include classifying the plurality of super pixels as foreground or background. The example embodiment of the method may also include shrinking the segmentation mask consisting of multiple super pixels based on classification as background or foreground. In another example embodiment the method may also include removing island pixels based on classification as background or foreground; and setting matting layers based on pixel classification as background or foreground. In another example embodiment an apparatus is provided that includes a processor and a memory including computer program code, the memory and computer program code configured to, with the processor, cause the apparatus to receive a set of focal stack images; calculate a focal measure for each of a plurality of pixels of the set of focal stack images; group each of a plurality of pixels for which the focal measure was calculated into a plurality of super pixels; calculate a focal measure for each of a plurality of the super pixels; segment a respective focal stack image based on the focal measures of the plurality of super pixels; calculate a color probability for respective super pixels; and segment the respective focal stack image based on the color probability of respective super pixels.

[0009] The memory and computer program code may be configured to, with the processor, cause the apparatus of an example embodiment to select a representative plurality of focal images from the set of focal stack images. The memory and computer program code may be configured to, with the processor, cause the apparatus of an example embodiment to align the set of focal stack images. The memory and computer program code may also be configured to, with the processor, cause the apparatus of an example embodiment to receive a selection of a focus frame; wherein the segmenting the respective focal stack image based on focal measure is further based on the selected focus frame; and wherein the segmenting the respective focal stack image based on color probability is further based on the selected focus frame.

[0010] The memory and computer program code may be configured to, with the processor, cause the apparatus of an example embodiment to classify the plurality of super pixels as foreground or background. The memory and computer program code may be configured to, with the processor, cause the apparatus of an example embodiment to shrink segmentation mask consisting of multiple super pixels based on classification as background or foreground. The memory and computer program code may also be configured to, with the processor, cause the apparatus of an example embodiment remove island pixels based on classification as background or foreground; and set matting layers based on pixel classification as background or foreground.

[0011] In a further embodiment, a computer program product is provided that includes a non-transitory computer readable medium having program code portions stored thereon, the program code portions configured, upon execution to receive a set of focal stack images; select a representative plurality of focal images from the set of focal stack images; calculate a focal measure for each of a plurality of pixels of the set of focal stack images; group each of a plurality of pixels for which the focal measure was calculated into a plurality of super pixels; calculate a focal measure for each of a plurality of the super pixels; segment a respective focal stack image based on the focal measures of the plurality of super pixels; calculate a color probability for respective super